

## 5. RISK ASSESSMENT

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### 5.1 DMA 2000 Requirements and Approach

**Requirement:** §201.4(c)(2): Risk assessments that provide the factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview. This overview will allow the State to compare potential losses throughout the State and to determine their priorities for implementing mitigation measures under the strategy and to prioritize jurisdictions for receiving technical and financial support in developing more detailed local risk and vulnerability assessments. The risk assessment shall include the following:

### 5.2 Identifying Hazards

As a part of the update process, all of the hazards profiled in the 2007 Plan were closely examined and screened by the Planning Team with regard to the same considerations used for the 2007 Plan update as follows:

- Prior knowledge of the relative risk associated with each of the hazards;
- Information from the hazard event database including any recent events occurring within the last three years;
- Comparison to hazards identified in local jurisdiction plans;
- The ability to effectively mitigate the hazard via the *DMA2000* process;
- The known or expected availability of information on the hazard;
- Duplication of the hazard's risk in other hazard definitions; and
- Whether or not the hazard is already being sufficiently addressed through other planning efforts of the State.

The prior knowledge of risks associated with each hazard summarized in the 2007 Plan stem from both the collective experience of the Planning Team members and the information presented in the 2007 Plan. During the 2007 Plan update process, several hazards were eliminated based on common sense experience associated with that hazard as it applies to the State of Arizona. For instance, it is known and can be demonstrated that in the geologic past some areas of the State have been impacted by volcanic activity. However, consideration of volcanic activity as even a minor risk to State assets is not relevant, and therefore, the hazard associated with volcanic activity was removed from further consideration. The resulting list of hazards evaluated in the 2007 Plan was:

- |                                 |                             |
|---------------------------------|-----------------------------|
| • Dam Failure                   | • Monsoon                   |
| • Drought                       | • Subsidence                |
| • Earthquake                    | • Thunderstorms/High Winds  |
| • Fissure                       | • Tornadoes/Dust Devils     |
| • Flooding/Flash Flooding       | • Tropical Storms/Hurricane |
| • Hazardous Materials Incidents | • Wildfires                 |
| • Landslides/Mudslides          | • Winter Storms             |

For the development of our 2007 Plan, the 2004 Plan database of historical hazard events was updated by returning to the variety of original resources to obtain updated information. The research was very thorough and involved such organizations as ADEM, The National Climate Data Center (NCDC), National Weather Service (NWS), US Forest Service, to mention a few. The 2007 Plan update also limited the database to events from 1966 to 2006 and was also purged of duplicate records and records that had little or no significant data associated with the event, to provide a more relevant and useful historic summary.

The original hazard event database was populated in step-wise manner. The first step was to review records from ADEM, FEMA, and the US Department of Agriculture (USDA) in order to identify and enter events that were declared a disaster or emergency by one or more of the following:

- Governor of Arizona;
- Secretary of the U.S. Department of Agriculture; or
- President of the United States.

Next, events were identified that, while not declared a disaster or emergency, caused sufficient one-time or repetitive damage to be considered a relevant hazard event. Using the same time period (1996-2006), a relevant event was one that had to meet one or more of following criteria:

- 1 or more fatalities;
- 1 or more injuries;
- \$50,000 or more in damages; or
- Significant event, as expressed in historical records or according to defined criteria.

The screening criteria are useful to eliminate small or minor events and focus the attention on hazards that cause major damages. The last criteria enables the inclusion of historic hazard events which often have relatively little specific information, but were considered significant enough to have gone into one or more historical records. Such entries were typically from narrative descriptions cited in a wide variety of sources that had been identified by ADEM. In the 2007 Plan, results from the historic hazard events database were summarized in two sets of tables. One set summarized only declared events and the second summarized all “other events.”

For this Plan update, the 2007 Plan historic hazard database was updated to include events and declarations that have occurred in the last three years. The previously established criteria was used without change. The time period for the updated database is 1966 to present. After review of the summary tables provided in the 2007 Plan and the updated database, the Planning Team chose to keep the tables summarizing the declared events and eliminate the tables summarizing the non-declared or “other events” since there was confusion about the data accuracy, its relationship to the declared events, and a general consensus that this data would be better summarized by hazard in the profile section of this Plan.

The following tables summarize the updated historic record of declared disaster events for the State of Arizona for the period of 1966 to present and the period of 2006 to present. It should be noted that the hazard category listed in these tables is the hazard that was identified for the declaration, and that it may not correspond identically to the hazard list for this Plan (e.g. – There have been three declarations for Monsoon, but Monsoon is not a hazard per se and is not in the 2007 Plan or Plan update list).

| Historical Record of Declared Disasters in Arizona, 1966 – March 2010 |                    |                  |          |               |
|---|--------------------|------------------|----------|---------------|
| Hazard  | Historical Records |                  |          |               |
|   | Number             | Recorded Damages |          |               |
|   | Total              | Fatalities       | Injuries | Total         |
| Dam Failure   | 3                  | 0                | 0        | \$0           |
| Drought   | 16                 | 0                | 0        | \$303,000,000 |
| Earthquake  | 1                  | 0                | 0        | \$0           |
| Fissure   | 0                  | 0                | 0        | \$0           |
| Flooding / Flash Flooding   | 53                 | 60               | 119      | \$640,123,000 |
| Landslide / Mudslide  | 1                  | 0                | 0        | \$0           |
| Levee Failure   | 0                  | 0                | 0        | \$0           |
| Snow Storm  | 8                  | 12               | 0        | \$750,000     |
| Sleet / Freezing Rain   | 0                  | 0                | 0        | \$0           |
| Subsidence  | 0                  | 0                | 0        | \$0           |
| Thunderstorm / High Wind  | 6                  | 0                | 11       | \$132,117,000 |
| Tornado / Dust Devil  | 0                  | 0                | 0        | \$0           |
| Tropical Storm / Hurricane  | 7                  | 27               | 1075     | \$783,205,000 |
| Wildfire  | 34                 | 6                | 28       | \$84,820,000  |



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Notes: Declared disasters refer to Presidential, Gubernatorial and/or USDA.  
 Fatalities, Injuries and Total Expenditures data sources can vary or be unavailable for some records.

Source: ADEM, 2010.

| <b>Historical Record of Declared Disasters in Arizona, 2007 – March 2010</b>   |                           |                         |                 |              |
|--|---------------------------|-------------------------|-----------------|--------------|
| <b>Hazard</b>  | <b>Historical Records</b> |                         |                 |              |
|  | <b>Number</b>             | <b>Recorded Damages</b> |                 |              |
|  | <b>Total</b>              | <b>Fatalities</b>       | <b>Injuries</b> | <b>Total</b> |
| Dam Failure  | 0                         | 0                       | 0               | \$0          |
| Drought  | 0                         | 0                       | 0               | \$0          |
| Earthquake   | 0                         | 0                       | 0               | \$0          |
| Fissure  | 0                         | 0                       | 0               | \$0          |
| Flooding / Flash Flooding  | 6                         | 2                       | 3               | \$24,377,000 |
| Landslide / Mudslide   | 0                         | 0                       | 0               | \$0          |
| Levee Failure  | 0                         | 0                       | 0               | \$0          |
| Snow Storm   | 0                         | 0                       | 0               | \$0          |
| Sleet / Freezing Rain  | 0                         | 0                       | 0               | \$0          |
| Subsidence   | 0                         | 0                       | 0               | \$0          |
| Thunderstorm / High Wind   | 0                         | 0                       | 0               | \$0          |
| Tornado / Dust Devil   | 0                         | 0                       | 0               | \$0          |
| Tropical Storm / Hurricane   | 0                         | 0                       | 0               | \$0          |
| Wildfire   | 0                         | 0                       | 0               | \$0          |
| Notes: Declared disaster refers to Presidential, Gubernatorial and/or USDA.<br>Fatalities, Injuries and Total Expenditures data sources can vary or be unavailable for some records. |                           |                         |                 |              |
| Source: ADEM, 2010.  |                           |                         |                 |              |

With the historic record in view, the 2007 Plan hazard list was discussed by the Planning Team. There was a general consensus that several of the hazard categories were better described as storm events wherein the effects of the storm may pose exposure to multiple hazards. For instance, hazards associated with a thunderstorm may include flooding, microburst winds, tornados, lightning and/or hail in a single event. Tropical storms/Hurricane is another storm event that may include damaging winds and heavy precipitation resulting in flooding. In both of these examples, the true resulting hazards are generally flooding and damaging or severe winds. Accordingly, the Planning Team chose to consolidate or eliminate several of the 2007 Plan hazards as follows:

**Hazardous Materials Incidents** – the Arizona State Emergency Response Commission addresses this hazard and our goal is to have this Plan focus primarily on natural hazards. Therefore this hazard has been eliminated from this Plan.

**Monsoon** – this seasonal period typically begins in midsummer and can last for several months. In Arizona the season is characterized by monsoon winds that bring humid subtropical air into the State. Solar heating then triggers afternoon thunderstorms that can produce devastating flash flood and wind related damages. The hazard category of Monsoon is eliminated as the damaging elements associated with the Monsoon season are primarily flood and severe wind related, which are covered elsewhere.

**Thunderstorm/High Winds** – damaging elements associated with thunderstorms include very intense bursts of precipitation, micro- and macro-burst winds, hail, lightning, and occasionally tornados. Accordingly, the hazard category of “Thunderstorm/High Winds” is eliminated as the flooding and severe wind effects are addressed in other categories.

**Tornado/Dust Devils** – damage producing tornadoes and dust devils are rare in Arizona and are usually associated with thunderstorm events. Additionally, mitigation of damages due to the typical type of tornado that impacts Arizona assets would be similar to those proposed for other severe wind events such as micro-bursts. Accordingly, this hazard is eliminated as a line item and will be incorporated into the Severe Wind category.

**Tropical Storms/Hurricanes** – the damaging elements associated with tropical cyclones are the heavy precipitation that results in flooding and severe winds. As with thunderstorm, these hazards are addressed elsewhere and this category is therefore redundant.

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The Planning Team also chose to add Extreme Heat and Levee Failure to the hazard list for Arizona. Extreme Heat was added based on the prominence of the hazard throughout much of state. Levee Failure was also added to address the State's increased focus on evaluating and determining the flood risk associated with the potential failure of a levee system. There is also a historic precedent for the inclusion of both hazards.

The profiles and historic hazard events summarized in each of the 15 county hazard mitigation plans, including seven county plan five-year updates that were at least in draft form, were studied to aid in identifying and screening hazards to determine statewide risk. The presumption was that the importance given to hazards by the local communities, would and should inform the prioritization of hazards at the State level. According to the county plans, the top hazards predominately and consistently identified were:

- Drought
- Flooding/Flash Flooding (Thunderstorms, Tropical Storms, General Storms, etc.)
- Severe Wind (Thunderstorms, Tropical Storms, Tornadoes, etc.)
- Wildfires

These top four hazards taken from the county plans are supportive of the hazards the Planning Team determined as the most important statewide.

The following list of hazards represents the result of the screening/identification process undertaken by the Planning Team. Each of these hazards will be addressed in the profiling and vulnerability assessment phases of the overall risk assessment for this Plan:

- |                           |                        |
|---------------------------|------------------------|
| • Dam Failure             | • Landslides/Mudslides |
| • Drought                 | • Levee Failure        |
| • Earthquake              | • Severe Wind          |
| • Extreme Heat            | • Subsidence           |
| • Fissure                 | • Wildfires            |
| • Flooding/Flash Flooding | • Winter Storm         |

In the 2007 Plan, a table was provided to map out the relationship of hazards in the hazards list, with the resultant risk that was due to that hazard. Short and long-term secondary effects were also identified. For this Plan update, these discussions have been moved to the hazard profile and vulnerability analysis sections.